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ABSTRACT

This booklet is intended to help secondary school teachers with content area reading instruction. Sections of the book contain step-by-step guidelines for successful reading experiences in business education, driver education, English, home economics, mathematics, music, science, and social studies. The booklet also contains a glossary of reading terms and appendixed information on the cloze procedure and the maze technique, the Fry Readability Formula, mapping, patterns of writing, creating structured overviews, constructing study guides, and content area vocabulary development. (RL)

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Guides for Teaching Secondary Students to Read in Subject Areas

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

This publication is dedicated to the late Lou Fitzgerald -- educator, administrator, consultant, friend -- for whom these *Guides* were the first step in a master plan aimed at improving reading instruction for students in the schools of Iowa.

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June, 1980

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Introduction

History

In April 1977 a selected group of educators representing local school districts, area education agencies, colleges and universities in Iowa was invited to attend a seminar concerning reading in secondary schools by representatives of the Iowa Department of Public Instruction (DPI). During that two-day seminar participants described a secondary school reading program for junior high schools and for senior high schools, considered problems in implementing reading programs in junior high schools and senior high schools, and proposed solutions which might be implemented by schools.

Encouraged by the results of this seminar, representatives of the DPI reconvened the seminar one month later, expanding the number of participants to include additional members from schools, area education agencies, colleges, and universities. A significant result of the second seminar on secondary school reading was the formation of a committee to explore the possibility of producing a simply written guide highlighting techniques which might help secondary school teachers teach their students to read subject area materials.

The committee met in the fall of 1977. The philosophy underlying this *Guides* was formulated. Members of the committee believe that:

1. Reading permeates the curriculum and subject matter teachers should teach those skills which students need to read subject matter successfully,

2. Text materials in different subject matter areas place different demands on adolescent readers;

3. Significant growth in the reading process occurs throughout the adolescent years and continuous attention to this potential growth is an important aspect of the secondary school curriculum;

4. Providing for continuous student progress in the ability to read requires coordination in instruction in reading from grade to grade, or level to level, kindergarten through grade twelve.

After considerable discussion, individual committee members wrote guides in subject fields where those committee members had experience. The committee as a whole reviewed each guide, but the writing style of the initial writer was retained. Guides were edited for consistency in design. This book is a result of the committee's efforts over the following two years.

Purpose

Guides for Teaching Secondary Students to Read in Subject Areas is intended primarily for classroom teachers of business education, driver education, English, home economics, mathematics, music, science, and social studies. Individual guides for those subject area teachers are the most important aspect of this publication. Each subject area guide is designed to provide a successful teaching experience for teachers in one of the eight aforementioned subject areas. Secondarily, these *Guides* are intended for the curriculum officers of each school district--the superintendent, principal, curriculum coordinators, department chairmen--and the local school district reading consultant, all of whom may be instrumental in promoting the use of *Guides* by classroom teachers. Third, these *Guides* are intended as a tool to be used by reading consultants charged with inservice training in reading for secondary school students. Fourth, these *Guides* are intended as a resource for college and university faculty members who instruct teachers and administrators interested in reading in the secondary school subject areas or who train beginning teachers in the eight subject areas. The committee focused its efforts only on vital elements of realistic classroom procedures. Users are encouraged to expand and improvise upon *Guides* in conjunction with coordinated inservice.

Suggestions for Implementation

Field testing of portions of these *Guides* has confirmed committee expectations that teachers already implement many of the sections of each guide. Few teachers discovered totally new ideas in these *Guides*. However, most teachers found sections in *Guides* that they do not regularly implement. Experience suggests that considerable time is required to examine and work through each subject matter guide--more than a brief series of sessions. Changes in teaching materials, differing student groups, and other variables could produce modifications in the use of each guide. And parts of each guide may be completed somewhat out of sequence. A teacher's reward for the expenditure of time and effort on these *Guides* is more comfortable teaching sessions and increased student learning.

The committee suggests that *Guides* be implemented with an inservice plan. Specific details of a school's inservice plan will vary with the diversity of faculty involvement. However, field testing has identified the following basic principles as important ones to include in all inservice plans.

1. A building administrator must support the faculty's decision to implement a guide. Also, the faculty must support the building administrator's interest in implementing the guide.

2. A selected guide in this book should be presented in an overview by a reading consultant to all interested faculty members. The building administrator should be present for this overview. All participants should understand the guide after this overview meeting.

3. After this overview meeting, the faculty should decide whether to use the guide. It is important that the faculty make the decision to implement the guide.

4. When a commitment to implement the guide is made, the consultant should take the faculty through the guide, step by step. Faculty efforts should result in an effective, functional assignment plan for each participating teacher. The time each faculty spends on inservice will vary. Each school must determine its own time-line.

The eight guides in this book suggest a process for teachers to use in assisting their students to read with greater understanding. As educators read through a guide they will notice that some terms are printed in italics. These terms are defined in a glossary in this book. Terms followed by an asterisk are illustrated by appropriate examples in the appendices of the *Guides*. Each guide is designed as a brief but complete pattern for a successful reading experience.

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Design for the Subject Areas

A successful reading experience, in the opinion of the *Guides* Committee, begins with certain assumptions about learning and teaching which are implicit in the eight guides which follow. A successful reading experience occurs when a teacher introduces appropriate reading selections to students who have been carefully prepared for reading by the presentation of appropriate vocabulary and background information.

Effective teachers (1) select materials for reading in which students can understand the concepts, and become interested in reading, (2) carefully explore with students why they are reading an assignment, (3) review the words in which concepts previously taught have been expressed, (4) teach new skills required to understand the reading materials before students are asked to read and review previously-learned skills when deemed necessary, (5) provide opportunities for students to express what they have learned, and (6) decide how to evaluate what students have learned.

These assumptions about learning and teaching will become apparent as a reader reviews the following eight guides. The guides are divided into parallel steps: (1) selecting reading materials, (2) planning assignments, (3) introducing reading materials, (4) guiding student reading, and (5) eliciting and evaluating students' responses to reading.

The guides are concerned with eight curricular areas. Guides for vocational agriculture and industrial arts, for example, are not included in this book. However, the five-step format used for eight guides can, we believe, be used as a guide for formulating a successful reading experience in these and other subject areas.

As these eight guides were developed by committee members, Iowa teachers and supervisors in these eight subject areas were asked to react to the developed materials. On the basis of these reactions, the guides were rewritten and refined. The *Guides* Committee is most appreciative of the suggestions offered by teachers and supervisors as this material was being assembled and field tested. Their contributions have added immeasurably to the practicality of the *Guides*.

Business Education

A Step-by-Step Guide to a Successful Reading Experience in Business Education.

Reading demands in bookkeeping, typing, shorthand, business law, sales, and consumer studies require students to use a variety of reading skills from following a set of directions to understanding a theoretical text. The following suggestions are offered to help a business education teacher assist students to understand course content objectives and to become independent learners in business education.

Step I. Selecting reading materials

A. Determine the purposes for which students will read course materials.

B. Determine the readability of text materials using a *readability formula* such as the Fry.*

C. Judge content for *concept density* and vocabulary load.

D. Determine the reading ability of students in course materials using the *cloze procedure.**

E. Determine the usefulness of course materials for specific students.

1. Identify students who will be able to learn from text materials with minimum or usual direction and guidance.

2. Identify students who will need special assistance in order to learn from reading course materials because of limited background knowledge.

3. Identify students who may be unable to learn from primary course materials and who need special materials, rewritten materials, assistance through media (tapes, films), or special tutoring.

Step II. Planning assignments

A. Refer to instructional objectives and determine purposes for reading specific selections.

B. Analyze materials for the following purposes:

1. to be sure that *concepts* expected to be learned or directions expected to be followed are included in the materials;

2. to discover major concepts presented and, in relation to course objectives, to discover which of these concepts to hold students responsible for;

3. to determine if additional background experiences or concepts are needed by students in order for them to learn the concepts in the text;

4. to identify *key vocabulary*;

5. to identify particular skills which students will need to apply. In addition to *general vocabulary*, business education materials often require the following:
   a. reading with great accuracy and precision,
   b. reading tables, graphs, charts,

Italics -- Terms in italics are defined in the glossary.
* -- Terms followed by an asterisk are illustrated by examples in appendices.

c. reading symbols and formulas,
d. reading to follow directions for immediate application,
e. reading special forms (invoices, legal papers, etc.),
f. reading *technical vocabulary* which may present phonic and word analysis problems for some students;

6. to identify patterns of writing* used to convey ideas

C. Prepare experiences to provide concepts for those students who need additional background in order to understand text concepts.

D. Prepare a structured overview* using key terms to provide direction and purpose for students' reading.

E. Prepare a *study guide** which will meet the needs of students on different reading and concept levels.

F. Identify students who will need special materials or assistance in this assignment.

Step III. Introducing reading materials

A. Present the assignment to student groups using readiness activities, a structured overview, and motivational or interest activities.

B. Introduce key vocabulary needed for students to understand the concepts. Review other essential vocabulary.

C. Tell students the purposes for which they are reading.

Step IV. Guiding student reading

A. Begin reading and studying in an organized manner using a procedure such as *SQ3R*.

B. Use *context* to understand difficult vocabulary.

C. Use reference aids and study aids within a text.

D. Use outside references and sources of information in the area of business education as well as general references.

E. Help students use a study guide as an aid to interpreting the selection(s) if a guide seems appropriate.

F. Provide extended activities for students to meet and extend instructional objectives as well as to follow up on individual interests.

Step V. Eliciting and evaluating students' responses to reading

A. Provide opportunities for students to share experiences with their peers:

1. by relating to assigned purposes,

2. by relating to background experiences.

B. Help students gain independence by moving from text directions to self-application tasks.

C. Determine student achievement with respect to major purposes of the assignment.

D. Provide for continuing understanding by relating previous assignment learning, present assignment learning, and learnings from future assignments.

Driver Education

A Step-by-Step Guide to a Successful Reading Experience in Driver Education.

Students in driver education vary tremendously in reading abilities. Adequate emphasis on readiness to read an assignment, attention to individual differences in reading ability, and attention to essential reading components are crucial to a successful reading experience.

Step I. Selecting reading materials

A. Determine the purposes for which students will read.

B. Assess the importance of reading materials in relation to hands-on experiences and demonstrations.

C. Judge the difficulty of reading materials.

1. Use a *readability formula* such as the Fry*.
2. Check diagrams for clarity and practicality.
3. Determine at what levels of *comprehension* important meanings are conveyed.
4. Evaluate *concept difficulty* and *concept density*.

D. Determine whether the style of writing adequately represents every-day language.

E. Evaluate the effectiveness of the reading materials.

1. Do the reading materials clearly support the purposes for reading?
2. Evaluate the diagrams to determine if they are clear and multi-dimensional.

Step II. Planning assignments

A. Administer a *cloze procedure* to determine student ability to read material.

B. Determine the purpose for reading a selection.

C. Identify the reading skills necessary to complete the assignment.

Example: Does a student know how to read the diagrams, forms, pictures, and graphs?

D. Determine what patterns of writing* are used to convey information.

E. Isolate the vocabulary to teach.

F. Determine the interrelationship between reading and driving experiences: identify, predict, decide, and execute (IPDE process).

Italics -- Terms in italics are defined in the glossary.
* -- Terms followed by an asterisk are illustrated by examples in appendices.

Step III. Introducing reading materials

A. Relate new assignment to previous learning.

B. Teach the *key vocabulary* and/or phrases. Limit new vocabulary to five to seven words and/or phrases. Review other essential vocabulary.

C. Check student understanding of visuals.

D. Provide a clear assignment and a *study guide** if appropriate.

Step IV. Guiding student reading

A. Provide classroom time for silent reading of materials. Observe students reading, and provide needed assistance.

B. Help students discover answers to questions formed from purposes.

C. Help students use study guides if provided.

Step V. Eliciting and evaluating students' responses to reading: following through into practical experience

A. Provide opportunity for students to express their understanding of *concepts* learned through reading.

B. Reinforce student comprehension of materials through practical application in simulative experience and actual driving.

- *notes* -

English

A Step-by-Step Guide to a Successful Literary Reading Experience in an English Classroom.

An English teacher is responsible for teaching reading to the extent that a knowledge of reading affects a student's ability to understand and to interpret literature and writing. Many of the tasks assigned students in English classes require adequate reading ability: reading a literary work, reading literary criticism, reading nonfiction, reading outlines, reading spelling lists, reading vocabulary lists, reading aloud, reading other students' writings, reading personal writing, reading examination questions--the list is virtually endless.

The reading abilities of students in English classes are almost as varied. The following guide may help an English teacher prepare a literary reading experience which will stimulate the interests and meet the needs of many students.

Step I. Selecting reading materials.

A. Select purposes for reading.

B. Judge the interest level: will students of this age and sex want to read this/these selection(s)?

C. Judge difficulty: use Fry* *Readability Formula* or a comparable one.

D. Judge content: examine the selection(s) for *concept* difficulty and *concept density*. Make a list of the *concepts*. Can students handle the concept difficulty?

E. Judge vocabulary: what words must students understand to comprehend the concepts? Perhaps create a graph of the concepts and the words needed to understand concepts in the following fashion:

F. Evaluate the *instructional reading level* of the selection(s): is/are the selection(s) on the *independent reading level* for students?

G. Identify students who will need special assistance in assignments in order to read the selection(s).

Step II. Planning assignments

A. Determine the purpose(s) for reading the selection(s).

B. Assess *reading load:* how many minutes of reading time must be allotted for students to read the complete literary selection(s)?

C. Identify the reading skills necessary to accomplish the purpose(s).

Examples: discovering point of view, identifying and reacting to mood or tone.

D. Decide how the reading skills are to be reinforced: (1) reviewed before reading, (2) introduced before reading, (3) assured as a learned consequence of reading.

E. Identify the patterns of writing* used to convey ideas in the reading material.

F. Analyze the levels of *comprehension* in which important meanings are conveyed in the reading material(s).

Italics -- Terms in italics are defined in the glossary.
* -- Terms followed by an asterisk are illustrated by examples in appendices.

Step III. Introducing reading materials.

A. Build anticipation-motivation for purposes of an assignment using some or all of the following:

1. Introduce *key vocabulary*: approximately five to seven words or phrases. Review other essential vocabulary.

2. Tell students what questions (purposes) they are reading to answer.

3. Relate this assignment to an overall literary theme, genre, or topic.

4. Provide an appropriate *study guide** for students.

B. Provide an appropriate reading experience:

1. Read aloud a selection or a portion of a selection or ask a good student reader to read a selection aloud.

2. Observe students reading silently and help those students who are having problems reading.

Step IV. Guiding student reading

A. Help students discover answers to questions which have been formed from purposes.

B. Help students relate this/these selections(s) to the overall theme, genre, or topic.

C. Help students use a study guide to interpret the selection(s) if this guide seems appropriate.

D. Help students use *mapping** to understand relationships in the selections if a map seems appropriate.

Step V. Eliciting and evaluating students' responses to reading

A. Provide opportunities for students to share literary experiences with peers and teachers:

1. by relating to assigned purposes,

2. by relating to background experiences,

3. by relating to further studies in literature.

B. Provide opportunities for students to evaluate literary experiences with peers and teachers:

1. by relating to assigned purposes,

2. by relating to other literary experiences.

C. Provide opportunities for students to synthesize personal responses to literature.

1. by summarizing what is learned through speaking or writing,

2. by comparing and/or contrasting what is learned through reading with previous learning by speaking or writing.

Home Economics

A Step-by-Step Guide to a Successful Reading Experience in Home Economics.

A home economics teacher, whether teaching consumer and homemaking education or occupational home economics, helps students read a wide variety of materials. The home economics curriculum draws on various academic specialities such as biology, chemistry, sociology, psychology, and economics. Home economics students must know specialized vocabulary from these academic areas in order to read materials assigned by a home economics teacher. In addition, students are required to read directions, charts, tables, and illustrations. The following guide may help home economics teachers assist their students in reading assigned materials.

Step I. Selecting reading materials

A. Select and sequence the *concepts* you wish to teach.

B. Judge the difficulty of materials. Check the readability of materials to be read using the Fry* *Readability Formula.*

C. Examine the material for *concept density* and *concept difficulty.*

D. Examine the organization and patterns of writing* of the reading selections.

E. Evaluate illustrations and diagrams for clarity in relation to the concepts to be taught.

F. Determine students' ability to read course materials using the *cloze procedure.**

Step II. Planning assignments

A. Compare concepts you intend to teach with the presentation of concepts in reading materials. Are more concepts presented in the reading materials than will be taught?

B. Determine the purposes for reading the assignment. How does the material to be read relate to the purposes of the assignment?

C. Identify reading skills students need to grasp concepts.

Examples: noting *cause and effect* relationships in home health care materials, determining sequence in child development readings.

D. Identify the *key vocabulary* which students must learn in order to understand concepts.

E. Determine the relationship between reading and practical experiences students have had and will have.

Step III. Introducing reading materials

A. Point out to students the purposes for which they will be reading.

B. Show students how reading materials are organized and tell them at what levels of *comprehension* important ideas are conveyed.

C. Preview materials with students by reading headings or introductory paragraphs and graphic aids (tables and charts).

Italics -- Terms in italics are defined in the glossary.
* -- Terms followed by an asterisk are illustrated by examples in appendices.

D. Relate materials to students' experiences.

E. Introduce key vocabulary. Limit new vocabulary to five to seven words or phrases. Review other essential vocabulary.

F. Analyze the patterns of writing used in reading materials.

Step IV. Guiding student reading

A. Ask students to read the selection(s) to pursue purposes.

B. Help students use *study guides** as an aid to interpreting the selection(s).

Step V. Eliciting and evaluating students' responses to reading

A. Provide opportunities for students to discuss what they have read:

1. by relating it to their background experiences,

2. by relating it to assigned purposes.

B. Help students transfer the ideas they have learned through reading and participating in class to new situations.

Examples: creating a family budget, developing shopping skills, interpreting contracts, organizing a story-time session for preschool children.

- *notes* -

Mathematics

A Step-by-Step Guide to a Successful Reading Experience in Mathematics.

Before applying the steps outlined below, the mathematics teacher should have a useful knowledge of:

1. course goals, objectives, and basic sequences in subject matter;
2. student attitudes and feelings toward studying mathematics;
3. general student abilities in mathematics (for example, previous grades, standardized test scores);
4. text, and other reading materials available.

Robert Kane, Mary Ann Byrne, and Mary Ann Hater observe:

> *Many of the skills taught in school reading programs can be applied to the task of reading in the language of mathematics. On the other hand, a number of differences exist which suggest additional reading skills needed in the language of mathematics as well as modifications of reading skills useful in ordinary English. Some of these additional reading skills are 1. reading speed, 2. ordering symbols, 3. reading with pencil and paper, 4. reading graphic materials, 5. page organization, 6. main ideas and important details, 7. words with many meanings, 8. using mathematical words, 9. seeing and understanding symbols, 10. object, idea, words, symbols, 11. problem solving 12. helps in computing, 13. search for meaning.*[1]

The following suggested steps were designed with these additional reading skills in mind.

Step I. Selecting reading materials

A. Assess the importance to be placed on reading as compared to lectures, demonstrations, in-class experiences. Follow subsequent steps in this procedure for learning through reading.

B. Determine student ability with the proposed reading material by using one or both of the following methods:

1. *cloze procedure**,
2. *sample passage informal reading test.*

C. Assess the usefulness of the following text aids in fulfilling intended objectives:

1. table of contents,
2. index,
3. glossary,
4. graphs,
5. illustrations,
6. symbols,
7. italics.

D. Identify the difficulty of the *general vocabulary* and be prepared to make compensatory adjustments.

[1]Robert B. Kane, Mary Ann Byrne, and Mary Ann Hater, *Helping Children Read Mathematics*, American Book Company, New York, 1974, passim.

Italics -- Terms in italics are defined in the glossary.
* -- Terms followed by an asterisk are illustrated by examples in appendices.

Step II. Planning assignments

A. From course objectives, specify the purpose(s) of the assignment.

B. Identify *key vocabulary* and symbols, the reading knowledge of which will be necessary for completion of the assignment. Consider limiting the number of new words or symbols.

C. Perhaps using the list from *Helping Children Read Mathematics*, identify the reading and study skills necessary for the successful completion of the assignment.

D. Determine the appropriate length of the reading assignment for these students based upon, for example, key vocabulary, *concept density*, or math skills.

E. Determine what subject matters are either absent or unclear in the reading and will have to be treated in other ways.

F. Analyze the patterns of writing* used and the levels of *comprehension* in which important meanings are conveyed.

Step III. Introducing reading materials

A. Relate the new assignment to previous learning, especially that which is enabling for the successful completion of the new assignment. Review if necessary.

B. Where possible, build anticipation-motivation by:

1. stating the educational purpose,
2. indicating the kinds of problems to be solved,
3. relating the tasks and skills to everyday life.

C. Introduce new vocabulary, symbols, and processes. Ascertain their having been learned with quick evaluations (oral testing, quick quizzes). Review other essential vocabulary.

D. Review necessary processes of reading using headings, graphs, summaries, and reviews.

E. If necessary, read aloud key parts of the assignment, perhaps during preliminary demonstrations of problem solving. Some important parts might be left for students to read.

Step IV. Guiding student reading

A. Provide time in class for silent reading and other uses of reading material. Observe and provide assistance to individuals with difficulties.

B. Assess student progress in process by observing the degree(s) with which they are completing concrete tasks (like problem solving).

Step V. Eliciting and evaluating students' responses to reading

A. Give students the opportunity to share feelings, learnings, and applications with new experiences or problems.

B. Determine if possible what areas of difficulty encountered by specific students were due to reading problems.

C. Formulate measures (such as tests) to determine how well each of the previous steps was successfully completed.

Music

A Step-by-Step Guide to a Successful Reading Experience in Music.

In music, students, are confronted with both common and unique reading demands. History and backgrounds of music are likely to be presented in narrative or expository format; but the material often contains vocabulary which is specialized, or used in senses specific to the music-related content. Texts of songs have much in common with literary verse or poetry. In addition, there is a language of music notation, somewhat analogous to that of mathematics or science. The following steps were designed to help music teachers take advantage of the many opportunities to facilitate the teaching of music through attention to reading.

Step I. Selecting reading materials

A. Assess the importance that you will place on reading materials, that is, the balance among performance, demonstration and reading.

B. Judge the difficulty of reading materials.

1. Check visuals for clarity.

2. Judge whether musical notation is clear and understandable.

3. Assess vocabulary and sentence structure.

C. Evaluate the organization of reading materials. Do you identify with the major thrust of the reading materials?

Step II. Planning assignments

A. Determine the purpose for reading a selection.

B. Identify the following reading skills necessary to complete the assignment:

1. reading musical notation,

2. reading diagrams,

3. understanding vocabulary, particularly the foreign words, figurative language, and technical terminology.

C. Isolate the vocabulary to be taught.

D. Determine the interrelationship between reading and other components of your music program.

E. Analyze the patterns of writing* used to convey information.

F. Identify the levels of *comprehension* at which the important meanings are conveyed.

Step III. Introducing reading materials

A. Relate reading assignments to the intended musical outcome and previous related learning.

B. Determine student background of knowledge and sensitivity. Provide appropriate awareness activities.

Italics -- Terms in italics are defined in the glossary.
* -- Terms followed by an asterisk are illustrated by examples in appendices.

C. Teach the *key vocabulary*, phraseology, notations. Review other essential vocabulary.

D. Provide a *study guide**, if applicable.

Step IV. Guiding student reading

Be available to assist students with vocabulary, phraseology, writing patterns, *concept* development, and other elements of a lesson.

Step V. Eliciting and evaluating students' responses to reading: following through into performance and/or discussion.

Reinforce student comprehension of what has been read by relating it to a performance or a demonstration through discussion.

- notes -

Science

A Step-by-Step Guide to a Successful Reading Experience in Science.

Before applying the steps outlined below, a science teacher should have a useful knowledge of:

1. course goals, objectives, and basic sequence of subject matter;
2. student attitudes and feelings about the study of science;
3. student abilities in science, for example, previous grades and test scores;
4. course texts and other reading materials available for use in the classroom.

Many of the skills taught in school reading programs may be applied to reading the language of science. However, the following skills are unique in their emphasis to the study of science:

1. adjusting reading speed to the special needs of science;
2. seeing, understanding, ordering special scientific symbols;
3. reading science graphs;
4. determining main ideas--especially defining a problem--and discovering supporting details or evidence;
5. learning and using scientific terms;
6. using problem-solving techniques;
7. computing and performing other mathematical tasks.

Science teachers are aware of the special importance of an investigative, experimental attitude which may be applied to the reading-study process.

The following steps should be considered with the above skills and principles in mind.

Step I. Selecting reading materials

A. Assess the importance to be placed on reading compared to lectures, demonstrations, and experiments.

B. Determine the difficulty level of the proposed reading material using the Fry* *Readability Formula* or a comparable formula. In applying the Fry formula, sample passages should contain exercises and/or experiments as well as explanatory material.

C. Determine the abilities of your students to read proposed reading material by using a *cloze procedure** and/or a *sample passage informal test.*

D. Assess the usefulness of the following textbook aids in your proposed reading material:

1. table of contents,
2. glossary,
3. index,
4. graphs and tables,
5. illustrations,
6. symbols,
7. italics.

Italics -- Terms in italics are defined in the glossary.
* -- Terms followed by an asterisk are illustrated by examples in Appendices.

E. Identify the patterns of writing* used in the reading materials which a student must understand to fulfill the objectives of the assignment.

F. Assess the difficulty of the and be prepared to make compensatory adjustments for students unable to understand the text.

G. Compare the length of text divisions (including introductions, explanations, summaries, problems, and examples) to student interests and abilities. Consider *concept density, concept difficulty,* and *content relevance.*

Step II. Planning assignments

A. Specify the purpose(s) or objective(s) for this assignment from course objectives.

B. Identify *key vocabulary* and symbols which students need to know for successful completion of the assignment. Consider limiting the number of words and/or symbols to seven or less, using smaller segments of material if key vocabulary is dense. Consider *technical vocabulary* for future assignments.

C. Identify necessary skills from the suggested list at the beginning of this guide and consider teaching methods for those skills.

D. Consider using *SQ3R,* a structured overview*, and/or a *study guide**. Prepare necessary materials.

E. Determine what subject matters are missing from, or unclear in the reading materials. Decide how to treat these subject matters.

Step III. Introducing reading materials

A. Relate the new assignment to previous learning, especially that which is enabling to the new assignment. Reinforce, review if necessary.

B. Build anticipation-motivation by:

1. stating the educational purposes,
2. indicating the issues or problems involved,
3. relating the assignment to everyday life.

C. Before students read, introduce key vocabulary and processes, and ascertain with quick evaluations that words and processes have been learned. Review other essential vocabulary.

D. If helpful, review some of the aids for reading headings, graphs, summaries, and glossary.

E. Review patterns of writing needed to fulfill objectives.

F. If necessary, read aloud key parts of the assignment, perhaps demonstrating the thought processes expected of students in reading the entire assignment.

Step IV. Guiding student reading

A. Observe students reading silently, providing individual assistance for students who have difficulty reading with understanding. Perhaps by observing how students complete a worksheet, or answer study guide questions, the teacher can discover which students need individual help.

B. Measure successful reading by observation and by discussion.

Step V. Eliciting and evaluating students' responses to reading

A. Provide immediate opportunity for students to share their learning, feelings, and appreciations from their reading. Reinforce (reward) responses.

B. Determine, if possible, what difficulties in learning were due to the reading materials, and what difficulties were due to the subject matter. Try to compensate.

C. Determine how well each of the previous steps was completed through tests, follow-up assignments, and applications. Adjust the step-by-step process to accommodate student learners.

Social Studies

A Step-by-Step Guide to a Successful Reading Experience in the Social Studies.

Secondary social studies material involves the content areas of anthropology, sociology, economics, geography, history, political science, psychology, and social psychology. The reading materials dealing with these interdisciplinary areas include textbooks, fiction, newspapers and case studies. Each of these materials requires an application of different *reading techniques* in order for students to acquire essential information.

Students vary in their ability to use appropriate reading techniques.

The following step-by-step guide suggests a process whereby teachers can help students read the content materials for successful completion of course assignments. This step-by-step process includes common reading techniques which are useful for understanding a range of material and which can be applied by students of varied reading abilities.

Step I. Selecting reading materials

A. Select and sequence the material to be taught. When the material to be used has been identified, the teacher can then:

1. identify the general topics which will be taught,

2. establish a unit plan or a single lesson for this material.

B. Estimate the reading difficulty level of the selected material by means of the Fry* *Readability Formula*. When the estimated reading difficulty level is known, the teacher can use this information to decide on assignment making strategies.

C. Identify within the reading materials of the selected general topic or unit the *concepts* to teach. When these concepts are identified the teacher can judge the *concept density* from the following aspects:

1. How many concepts of those presented in the reading material will be taught?

2. How are concepts distributed throughout the material? Where does a massing of concepts occur?

D. Identify the *instructional reading level* of the material vis-a-vis the learner. An efficient and effective group administered technique is the *cloze procedure**. Results of the cloze procedure will identify students who are above, at, or below instructional level on a given text or reading.

Step II. Planning assignments

A. Begin planning for each assignment by identifying purpose(s) or goal(s) for the assignment so that a degree of success can be determined later.

B. Identify how the material should be read to accomplish stated purposes/goals of the assignment. When the reading techniques necessary to accomplish the purposes/goals have been identified, the teacher can directly teach those techniques which students needs.

C. Select the reading techniques which are to be maintained and/or reinforced. When these techniques are identified, the teacher can assign appropriate activities suitable for students to practice selected skills.

D. Identify the *technical vocabulary* which leads to concept development on the part of a learner. A teacher can purposefully plan directed teaching activities with a technical vocabulary which can lead a student to a conceptual understanding of the context.

E. Identify the patterns of writing* with which students need to be familiar to understand the concepts.

Step III. Introducing reading materials

A. Explain the purposes of the reading assignment to the students.

B. Directly teach reading techniques (i.e., *skimming, cause-effect,* map-chart reading, fact-opinion) which are needed to complete the assignment.

C. Directly teach the technical vocabulary used for concept development.

D. Relate learnings/purposes to the students' experiences or previous understandings.

Step IV. Guiding student reading

A. Following the group preparation activities differentiate the reading assignments. Allow for differing levels of independent work in accomplishing the assignment(s).

B. Guide the student reading of the assignment by using the following two major techniques--either separately or in tandem.

1. Use of a *study guide**:

   a. Discuss reading/study guides, identifying important concepts, relationships and generalizations.
   b. Relate the reading/study guide to the printed material, point out how the study guide reflects the organizational scheme of the material.

2. Discussion.

   a. Discuss the major purposes for reading the assignment.
   b. Identify and discuss the organizational pattern of the printed material.
   c. Relate this pattern to the major purpose, by discussing the major concepts, relationships and generalizations.
   d. Clarify and focus student thinking with the use of appropriate, pre-planned questions.

Step V. Eliciting and evaluating students' responses to reading.

A. Provide the opportunity for students to share their new assignment information.

B. Ask students to *synthesize* new learnings and relate them to the major purpose(s) of the assignment.

C. Whenever possible, relate new learnings to meaningful (i.e., background) experiences of the students.

D. Determine what students have achieved with respect to the major purpose(s) of a given assignment.

E. Provide for continuing development of understandings by relating previous assignment learnings to future assignments.

Glossary.

1. *Cause and effect:* A relationship in which certain events or conditions (the causes) are responsible for subsequent or concomitant events or situations (the effects).

2. *Cloze procedure:* A method of testing a reader's understanding of the total context of written material. Words are removed from a passage, usually at regular intervals, and the reader predicts the words that were removed and replaces them. Sometimes the exact words are required, at other times appropriate synonyms are accepted. In attempting to replace deleted words, the reader is forced to pay attention to the message of the passage as conveyed by the remaining words. (If exact words are required a teacher is testing a reader's vocabulary; if synonyms are allowed the teacher is testing the reader's knowledge of syntax and use of context.) See the example in the Appendices.

3. *Comprehension:* Understanding material that has been read. This statement is deceptively simple because reading material may have several levels of meaning. A reader must understand printed material on a *literal level* (for example, recognizing the accepted meaning of the words, noting the sequence of ideas), before going beyond the words provided by the writer to the *interpretative level* (at which the reader may note the cause and effect relationships between ideas and draw some conclusions). At the *critical level* the reader evaluates the message by determining the point of view and, in expository writing, considers the writer's qualifications for writing on this subject. Finally, at the *creative level* the reader uses what has been read as a basis for reconsidering ideas and formulating new ideas.

4. *Concept:* An idea. A concept may vary considerably as to the level of abstraction. For example, the following concepts vary in levels of difficulty from precise to inclusive:

   voting
   democracy
   individual freedom

   See *levels of meaning* in this Glossary.

5. *Concept density:* The number of concepts present in a given amount of printed material. If the concept density is well-balanced a reader should understand the printed matter; if the concept density is too heavy a reader may not select the important concepts to understand that are important for achieving a reader's purpose.

6. *Concept difficulty:* The abstractness of concepts present in printed matter. Concepts presented in concrete language may be easy to grasp, but often abstract concepts are developed with complicated language patterns which are difficult for a reader to understand.

7. *Content relevance:* The degree to which assigned reading material relates to the specific objectives the teacher wants students to accomplish. A reading assignment is inappropriate if it exceeds the teacher's objectives or fails to cover the teacher's objectives.

8. *Context:* The verbal setting within which a word or phrase is used.

9. *Frustration reading level:* Reading a selection with only 90% accuracy in word identification and/or only 50% accuracy in comprehension. For example, while reading a page of 300 words a reader cannot identify 30 words. This reader is within the frustration level on that printed passage. A reader will not learn using material that is this difficult to understand. See *independent reading level* and *instructional reading level* in this Glossary.

10. *General vocabulary:* Words which appear in everyday written English used in every content area.

11. *Independent reading level:* Reading a selection with 99% accuracy in word identification and 95% accuracy in comprehension. For example, while reading a page of 300 words a reader can identify all but three words and be an effective independent reader. See *frustration reading level* and *instructional reading level* in this Glossary.

12. *Instructional reading level:* Reading a selection with 95% or better accuracy in word identification and 75% or

better accuracy in comprehension. For example, while reading a page of 100 words a reader can identify all but 15 words and be within the instructional reading level for that printed passage. See *frustration reading level* and *independent reading level* in this Glossary.

13. *Key vocabulary:* Words that a reader must know to understand a specific reading assignment. Only a few--five to seven--key vocabulary words should be taught in order for a student to read an assignment.

14. *Levels of meaning:* When read, words may evoke different levels of meaning which are related to the nature of the words but also to the reader's reaction to the words. Levels of meaning are suggested by these relative dimensions of meaning:

fact ← → opinion
objective ← → subjective
denotation ← → connotation
specific ← → general
concrete ← → abstract

In general, meaning at the left ends of the above scales tends to be precise while meaning at the right ends of these scales tends to be more inclusive. A successful reader learns to reconstruct meaning critically by differentiating opinion from fact, by resisting inappropriate connotation and overgeneralization, that is by using sound, personal critical thinking.

15. *Mapping:* A pictorial representation of the ideas in a reading selection. See the example in the Appendices.

16. *Readability formula:* A method of estimating the reading difficulty for printed matter. Computed by counting the number of words in sentences, the number of syllables in the words or the length of the words, and sometimes the number of familiar words in a passage and averaging the results. The method of computation suggests the limitations of readability formulas. They do not measure a reader's interest in the printed matter or the reader's ability to understand concepts included in the printed matter or the reader's ability to cope with the concept load of the printed matter. The Revised Fry Readability Formula, along with directions for using the formula, is included in the Appendices.

17. *Reading load:* The time required for a reader to read an assignment with understanding. It is determined by dividing the total number of words to be read by the average words per minute the reader can read.

Formula: $\frac{\text{words}}{\text{time in seconds}} \times 60 =$ _____words per minute (w.p.m.)

Example: Sue reads 400 words of moderately difficult material in 2 minutes and 42 seconds. Her formula is

$\frac{400 \text{ (words)}}{162 \text{ (seconds)}} \times 60 =$ approx. 147 words per minute

If Sue is asked to read Washington Irving's "The Devil and Tom Walker" (approximately 4900 words), it will take Sue 33 minutes to read the story.

18. *Sample passage informal reading test:* A portion of a reading selection in a student's text which a teacher has chosen from the beginning of a chapter for testing purposes. The student is asked to read the passage silently while observed by the teacher and without reference to the passage answers questions the teacher has prepared over the passage or tells the teacher what has been read.

19. *Scanning:* Reading to locate a fact or concept in written material: the reader may need a date, a description, a sequence of events, etc. The technique is used to obtain specific information.

20. *Skimming:* Reading to gain a general knowledge of written material, often a preliminary first reading of the material. The reader looks for chapter headings and sub-headings while attempting to understand the focus of the material. The technique is often used to estimate how appropriate the material is for the reader's purpose.

21. *SQ3R:* An acronym for a program designed to help readers develop effective study habits. The symbols in the acronym represent:

    S = Skimming--to gain a general impression of printed matter.
    Q = Questioning--to form questions likely to be answered in the printed matter.
    R = Reading--to locate and learn the answers to the questions.
    R = Recalling--to mentally review the questions and their answers.
    R = Reviewing--to locate answers missing or incomplete while recalling.

22. *Study guide:* A written guide which should help a reader (1) set purposes for reading certain written selections, (2) relate ideas learned from reading by providing suggested relationships, and (3) suggest related readings which may broaden a reader's understanding of a subject. See the example in the Appendices.

23. *Synthesize:* A stage in thinking when what the learner already knows and what he is learning now are combined, usually creating expanded knowledge or new ideas.

24. *Technical vocabulary:* Words which have specific meanings that a reader must know to understand an assignment in a particular content area.

Appendices

Cloze Procedure

A technique to determine if a particular reading selection is appropriate for students' reading ability. The term cloze, coined by Wilson Taylor (1953), was chosen because this procedure is based on the psychological principle of closure and the linguistic concept of redundancy in the English language. A brief explanation of this procedure also appears in the Glossary.

Constructing a cloze test:

1. Select a passage of 300 to 500 words from reading materials students in your class will be expected to read.
2. Type the first paragraph of the selection.
3. Beginning with the second paragraph delete words at regular intervals replacing them with numbered blanks of uniform length. If the selection is from a textbook (informative material) delete every tenth word. If the selection is from a story or newspaper article delete every fifth word.
4. Delete 50 words.
5. Finish the sentence in which the fiftieth deletion occurs, and copy the next sentence in full.

Administering a cloze test:

Provide directions like the following: "Please glance over the following selection. Then, go back and read it carefully supplying for each blank the word you feel the author may have used in writing this selection. Only one word has been deleted from each blank. Please write your answers after the appropriate numbers on the accompanying answer sheet. You will have as much time as necessary to complete this exercise."

Scoring the cloze:

1. If you wish to test your readers' mastery of vocabulary in the passage you should score as correct those responses which accurately match the deleted words. Disregard misspellings.
2. Scoring for the group: $\frac{\text{average number correct}}{\text{number of deletions}} \times = \_\_\_\_\%$

If the mean score for students in your group is:		The reading material is probably:
60% or above	=	independent reading level
40% to 60%	=	instructional reading level
less than 40%	=	frustration reading level

Example of a cloze test:

A sample cloze test constructed from a newspaper article which appeared in *The Des Moines Register* on Friday, March 30, 1979, appears on the following pages. We are grateful to the Associated Press for allowing us to reprint this article. The entire article is reproduced elsewhere in these appendices.

Cloze Procedure

Expert: Outside Danger Past in N-Plant Mishap

A federal inspector said Thursday that the threat of contamination to persons near the Three Mile Island nuclear plant was past, but low-level radiation continued to escape in one of the nation's most serious nuclear accidents.

"At this (1), the danger is over (2) people off site," said (3) Gallina, an inspector for (4) Nuclear Regulatory Commission who (5) been monitoring the plant (6) the accident was reported (7) Wednesday.

"Our readings show (8) levels have dropped significantly," (9) said, adding that contamination (10) a problem at the (11) and radiation was expected (12) lead through vents into (13) air for up to (14) week.

Senator Gary Hart, (15) of the Senate Public (16) subcommittee on nuclear regulation, (17) earlier during a visit (18) the site that the (19) was "the most serious (20)" involving nuclear power generation (21) the United States.

"This (22) to a major fallout (23) from a nuclear bomb (24)," said Dr. Ernest Sternglass, (25) of radiology at the (26) of Pittsburg, who measured (27) levels at the Harrisburg (28) Thursday morning, two miles (29) the plant site, and (30) them 15 times greater (31) normal background radiation.

However, (32) disputed that claim. "Any (33) between this type of (34) and fallout from a (35) is totally erroneous," he said.

Contaminated water vapor from (36) floor of a cooling (37) near the shut-down reactor (38) expected to continue entering (39) atmosphere until all the (40) is pumped out.

Despite (41) forebodings of Sternglass and (42), officials of Metropolitan Edison (43), which operates the plant (44) an island in the (45) River about 10 miles (46) of Harrisburg, said there (47) no danger to the (48).

As for Sternglass' comment, (49) Miller, a company spokesman (50), "We don't consider that a rational statement. It's kind of far out."

Cloze Procedure

Answer Key

(1)	time	(11)	plant	(21)	in	(31)	than	(41)	the
(2)	for	(12)	to	(22)	corresponds	(32)	Gallina	(42)	others
(3)	Charles	(13)	the	(23)	pattern	(33)	comparison	(43)	Company
(4)	the	(14)	a	(24)	test	(34)	fallout	(44)	on
(5)	has	(15)	chairman	(25)	professor	(35)	bomb	(45)	Susquehanna
(6)	since	(16)	Works	(26)	University	(36)	the	(46)	southeast
(7)	early	(17)	said	(27)	radiation	(37)	building	(47)	was
(8)	radiation	(18)	to	(28)	airport	(38)	was	(48)	Public
(9)	he	(19)	incident	(29)	from	(39)	the	(49)	Dick
(10)	remains	(20)	accident	(30)	found	(40)	water	(50)	said

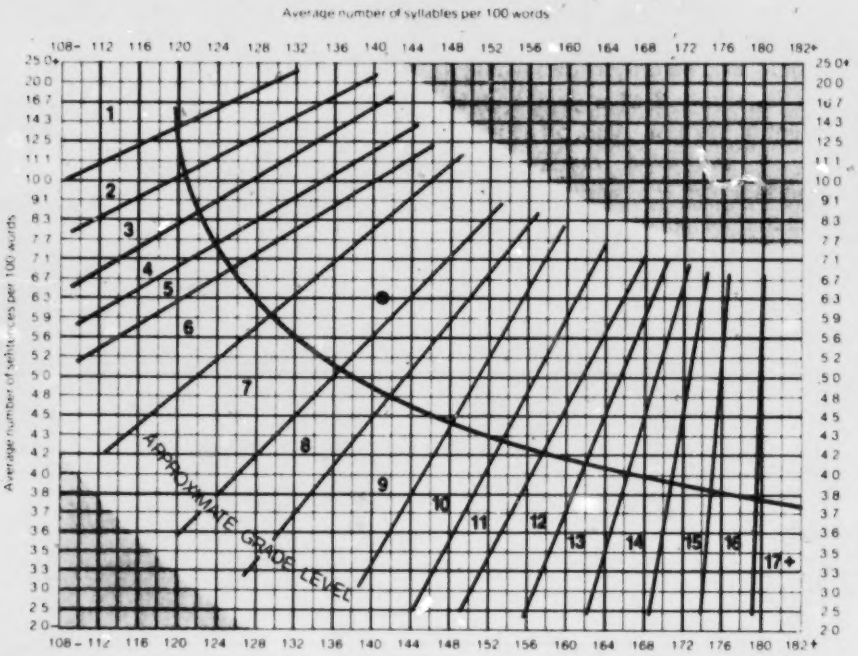
Fry Readability Formula

An easy-to-use readability formula constructed by Professor Edward Fry, Rutgers University. The formula is not copyrighted.

Figure 2

GRAPH FOR ESTIMATING READABILITY — EXTENDED

by Edward Fry, Rutgers University Reading Center, New Brunswick, N J 08904



Expanded Directions for Working Readability Graph

1. Randomly select three (3) sample passages and count out exactly 100 words each, beginning with the beginning of a sentence. Do count proper nouns, initializations, and numerals.
2. Count the number of sentences in the hundred words, estimating length of the fraction of the last sentence to the nearest one-tenth.
3. Count the total number of syllables in the 100-word passage. If you don't have a hand counter available, an easy way is to simply put a mark above every syllable over one in each word, then when you get to the end of the passage, count the number of marks and add 100. Small calculators can also be used as counters by pushing numeral 1, then push the + sign for each word or syllable when counting.
4. Enter graph with *average* sentence length and *average* number of syllables; plot dot where the two lines intersect. Area where dot is plotted will give you the approximate grade level.
5. If a great deal of variability is found in syllable count or sentence count, putting more samples into the average is desirable.
6. A word is defined as a group of symbols with a space on either side; thus, *Joe, IRA, 1945,* and *&* are each one word.
7. A syllable is defined as a phonetic syllable. Generally, there are as many syllables as vowel sounds. For example, *stopped* is one syllable and *wanted* is two syllables. When counting syllables for numerals and initializations, count one syllable for each symbol. For example, *1945* is four syllables, *IRA* is three syllables, and *&* is one syllable.

Note: This "extended graph" does not outmode or render the earlier (1968) version inoperative or inaccurate; it is an extension. (REPRODUCTION PERMITTED—NO COPYRIGHT)

Mapping

A technique for creating a picture of the ideas in a reading selection enabling a reader to see and remember the ideas.

Directions for mapping:

1. Glance over the reading assignment. Search for clues that the author or editor has selected some of the ideas in the reading assignment as the most important ones.
   These clues include: (1) questions placed at strategic points in the text (before and after the reading assignment), (2) boldface headings for certain sections of the text, and (3) boldface type used for some sentences in the text. If there are no clues in the text skip to Step 6.

2. Write these clues in your own words on a plain piece of paper spacing them in a pleasing design on the paper. Draw a square with a colored pencil or brightly-colored ink around each of these ideas.

3. Read the assignment noting the details which support these boxed clues. Record these details as satellite ideas around or under the appropriate clues. Draw circles with an ordinary pencil or dark ink around these satellite ideas.

4. Glance over the assignment again deciding whether the clues you recorded in the squares are the major ideas in this assignment.
   If you discover an all encompassing idea other than those you have recorded or if you discover that one of the ideas you have recorded is really the all encompassing idea record that idea in a prominent place on your paper and surround it with a different colored line or draw the colored line around the idea you had already recorded.

5. Memorize your map. (*End of directions for mapping.*)

6. START HERE IF THE AUTHOR OR EDITOR DID NOT PROVIDE CLUES IN THE READING ASSIGNMENT. Number the paragraphs in the reading assignment. Read the selection rapidly noting the numbers of the paragraphs which seem to contain main ideas.

7. Go back and reread these noted paragraphs, and decide what the main idea(s) is/are in this selection. It may help to state these as questions. Write these ideas in your own words on a plain piece of paper spacing them in a pleasing design on the page. Draw a square with a colored pencil or brightly-colored ink around each of these ideas.

8. Read the assignment again, more slowly this time, noting the details which support these boxed ideas. Record these details as satellite ideas around or under the appropriate ideas. Draw circles with an ordinary pencil or dark ink around these satellite ideas.

9. Glance over the assignment again deciding whether the ideas you recorded in the squares are the main ideas in this assignment.
   If you discover an all encompassing idea other than those you have recorded or if you discover that one of the ideas you have recorded is really the all encompassing idea record that idea in a prominent place on your paper and surround it with a different colored line or draw the colored line around the idea you had already recorded.

10. Memorize your map. (*End of directions for mapping.*)

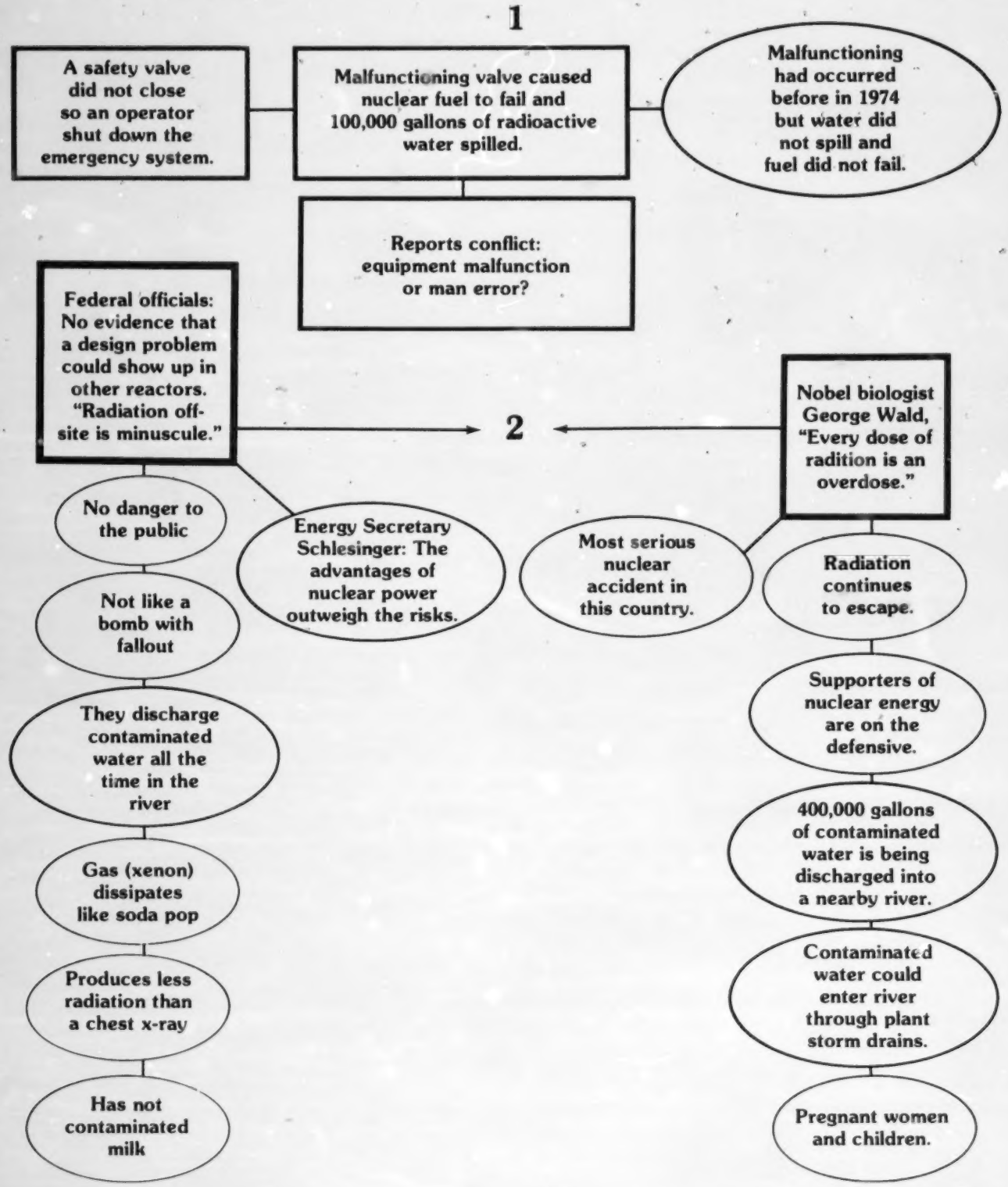
Examples of mapping:

On the following page is a sample map of an article which appeared in *The Des Moines Register* on Friday, March 30, 1979. There were no clues in this article so the map illustrates the second method of mapping described above. The complete article on which the map was based appears following the sample map. We are most grateful to the Associated Press for allowing us to reproduce this article.

Mapping

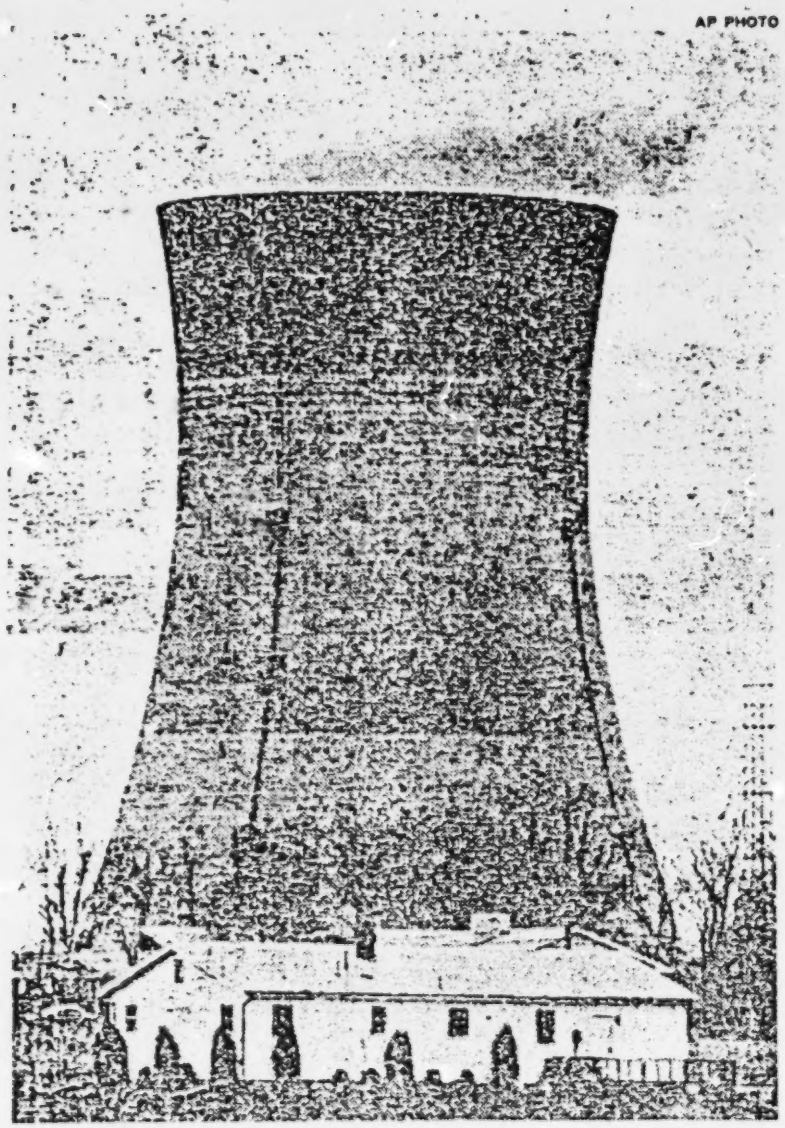
1. What happened at Three Mile Island?

2. Are nuclear power plants safe?


1
A safety valve did not close so an operator shut down the emergency system.
Malfunctioning valve caused nuclear fuel to fail and 100,000 gallons of radioactive water spilled.
Malfunctioning had occurred before in 1974 but water did not spill and fuel did not fail.
Reports conflict: equipment malfunction or man error?
Federal officials: No evidence that a design problem could show up in other reactors. "Radiation off-site is minuscule."
2
Nobel biologist George Wald, "Every dose of radition is an overdose."
No danger to the public
Energy Secretary Schlesinger: The advantages of nuclear power outweigh the risks.
Most serious nuclear accident in this country.
Radiation continues to escape.
Not like a bomb with fallout
They discharge contaminated water all the time in the river
Supporters of nuclear energy are on the defensive.
Gas (xenon) dissipates like soda pop
400,000 gallons of contaminated water is being discharged into a nearby river.
Produces less radiation than a chest x-ray
Contaminated water could enter river through plant storm drains.
Has not contaminated milk
Pregnant women and children.

Schlesinger: Faith in need for nuclear power unshaken

AP PHOTO



A cooling tower of a nucler power plant near Harrisburg, Pa., dwarfs a nearby home. The plant, co-owned and operated by the Metropolitan Edison Electric Co., was shut down Wednesday after an accident leaked radiation into the atmosphere.

EXPERT: OUTSIDE DANGER PAST IN N-PLANT MISHAP

HARRISBURG, PA. (AP) — A federal inspector said Thursday that the threat of contamination to persons near the Three Mile Island nuclear plant was past, but low-level radiation continued to escape in one of the nation's most serious nuclear accidents.

"At this time, the danger is over for people off site," said Charles Gallina, an inspector for the Nuclear Regulatory Commission who has been monitoring the plant since the accident was reported early Wednesday.

"Our readings show radiation levels have dropped significantly," he said, adding that contamination remains a problem at the plant and radiation was expected to leak through vents into the air for up to a week.

Senator Gary Hart, chairman of the Senate Public Works subcommittee on nuclear regulation, said earlier during a visit to the site that the incident was "the most serious accident" involving nuclear power generation in the United States.

"This corresponds to a major fallout pattern from a nuclear bomb test," said Dr. Ernest Sternglass, professor of radiology at the University of Pittsburgh, who measured radiation levels at the Harrisburg airport Thursday morning, two miles from the plant site, and found them 15 times greater than normal background radiation.

However, Gallina disputed that claim. "Any comparison between this type of fallout and fallout from a bomb is totally erroneous," he said.

Contaminated water vapor from the floor of a cooling building near the shut-down reactor was expected

NUCLEAR

Continued from Page One

to continue entering the atmosphere until all the water is pumped out.

Despite the forebodings of Sternglass and others, officials of Metropolitan Edison Co., which operates the plant on an island in the Susquehanna River about 10 miles southeast of Harrisburg, said there was no danger to the public.

As for Sternglass' comment, Dick Miller, a company spokesman said, "We don't consider that a rational statement. It's kind of far out."

In another development, more than 400,000 gallons of contaminated water from the disabled Three Mile Island nuclear power plant is being discharged into the Susquehanna River, federal and state officials said late Thursday.

The discharge can be made without harmful radioactive pollution of the river, said Clifford Jones, head of the state Department of Environmental Resources.

"There is an urgent need to begin discharging," said Jones.

The water is contaminated with a very slight level of xenon, a low-level contaminant, according to DER officials.

Officials from the Nuclear Regulatory Commission and the federal Department of Energy said such diluted waste water is discharged routinely from the plant under normal operating conditions.

Jones said plant officials fear that unless the diluted water is discharged, holding tanks would fill up and undiluted waste water would run directly into the river through storm drains.

"Most of it (xenon) will be dissipated like bubbles in soda pop," said DER spokesman Dave Milne. He said the gas decays after a few hours.

Joseph Hendrie, chairman of the Nuclear Regulatory Commission, said at a congressional briefing Thursday that the radiation outside the plant was far below that considered a hazard to the public. But he added, "It is not a level I think we ought to take casually."

Hendrie and other federal officials told the congressmen there is no evidence the malfunction was a design problem that would show up in other reactors.

John Herbein, vice president of generation for Metropolitan Edison, said, "We didn't injure anybody, we didn't over-expose anybody and we certainly didn't kill anybody. The radiation off site was absolutely miniscule."

Herbein said radiation readings indicate the level of exposure ranges from up to 20 millirems an hour at the site to as much as seven millirems in nearby towns. This is much less than what a person gets in a chest X-ray.

"There is no danger to the public." he said.

But critics attacked the company's no-danger posture.

"Every dose of radiation is an overdose," said Nobel biologist George Wald, professor emeritus at Harvard University, at an anti-nuclear conference. "A little radiation does a little harm and more of it does more harm."

Sternglass said, "The reaction of the community should be to stand up and scream. Risk for pregnant women and young children is significantly increased.

"It's not a disaster where people are going to fall down like flies. It's a creeping thing."

The accident apparently was triggered before dawn Wednesday when a valve malfunctioned, causing the nuclear fuel to fail and spilling more than 100,000 gallons of radioactive water. This melted about one percent of the metal cladding that protects the uranium pellets and contaminated the reactor building.

Walter Creitz, president of Metropolitan Edison, said "as long as man makes equipment nothing is absolutely safe."

Conflicting reports, from the company and from the Nuclear Regulatory Commission, which supervises safety and operation at 72 atomic power plants in the U.S., gave different accounts of whether the radiation escape was the result of equipment or human malfunction.

Hendrie told congressmen the system was turned off manually. "Whether in fact that was a mistake remains to be seen. . . ," he said. "These plants are more vulnerable to human error — in part because we have driven the probability of mechanical error way down."

Hendrie said a combination of malfunctions appears to have contributed to the mishap. He said a water filtering unit apparently malfunctioned, blocking the flow of water between the reactor and the generator turbine. In addition, he said, a water system designed to keep water levels high failed to operate correctly.

Then, as the core began to heat up, Hendrie said, a safety valve opened to relieve steam pressure. But once the emergency system kicked on, pumping water into the reactor, the valve failed to close. It was at that point, Hendrie said, that an operator shut down the emergency system.

Meanwhile, Lt. Gov. William Scranton III said one test for iodine isotopes in milk proved positive But the level, taken from a farm on the Susquehanna's east shore, was 1-50th of the federal safety limit.

Scranton, who added there is no need to consider evacuation, also said state officials are testing river water for radiation.

The plant, which has two reactors, began service in 1974. The other reactor was taken out of service last month for refueling, just two months after the No. 2 reactor began producing electricity.

"The same thing (a valve failure) happened two or three times on our first reactor in 1974 during the startup tests," Herbein said. "What didn't occur was the water spill and the fuel failure."

Meanwhile, amid cries of "cover up" and "we told you so" from nuclear energy opponents — and equally vehement defenses from its supporters — the accident at the Three Mile Island plant has generated renewed controversy over the safety of nuclear power.

One of nuclear power's most important backers, Energy Secretary James Schlesinger, said the accident that caused radiation to leak into the atmosphere Wednesday has not shaken his faith in atomic energy as an answer to this country's fuel problems.

"Nothing is riskless, but when one weighs the risks overall, the advantages of nuclear power exceed the risks," said Schlesinger, who was questioned about the accident at the National Association of Broadcasters convention in Dallas, Texas.

But another Energy Department official, who declined to be quoted by name, admitted that the accident had placed supporters of nuclear power further on the defensive.

Maze Technique

A modification of the cloze procedure suggested by John Guthrie (1973, 1974). See the example of cloze procedure elsewhere in these appendices.

Constructing a maze:

1. Select a passage from reading materials students will be expected to read in your class.

2. Type the entire first sentence of the passage.

3. Beginning with the second sentence delete every fifth or tenth word in the passage replacing each word with three alternative words: an incorrect word from another word class (for example, if the word is a noun substitute an adverb), an incorrect word of the same word class (for example, if the word is a noun substitute another noun), and the correct word. Be sure to vary the order of the alternate words. Delete about 20 words.

4. Finish the sentence in which the last deletion occurs.

Administering a maze:

Provide directions like the following: "Please glance over the following selection. Then, go back and read it carefully, choosing from each set of three words the word you feel the author may have used in writing this selection. Please circle the numbers of the appropriate answers on your selection. You will have as much time as necessary to complete this exercise."

Scoring a maze:

1. Scoring for the group: $\frac{\text{average number correct}}{\text{number of deletions}} = \_\_\_\_\_\%$

If the mean score for students in your group is:		The reading material is probably:
80% and above	=	independent reading level
65% to 80%	=	instructional reading level
less than 65%	=	frustration reading level

Group vs. individual maze:

Although a maze is usually constructed for a group of students, it can be administered individually and scored individually.

Example of a maze:

A sample maze test constructed from a newspaper article which appeared in *The Des Moines Register* on Friday, March 30, 1979, appears on the following pages. We are grateful to the Associated Press for allowing us to reprint this portion of the article.

Maze Technique

EXPERT: OUTSIDE DANGER PAST IN N-PLANT MISHAP

A federal inspector said Thursday that the threat of contamination to persons near the Three Mile Island nuclear plant was past, but low-level radiation continued to escape in one of the nation's most serious nuclear accidents.

1 fire	① off	1 as
"At this time, the ② danger is over for people	2 at site,"	said Charles Gallina, 2 tire inspector for the Nuclear
3 lovely	3 serving	③ an

1 Ambulatory	① monitoring	1 dipping
② Regulatory Commission who has been	2 electrifying the plant since the	2 experience was reported early
3 Entrepreneur	3 frontier	③ accident

Wednesday.

① Our	1 become	① adding
2 "Three readings show radiation levels	② have dropped significantly,"	he said 2 saying that contamination remains
3 As	3 accordingly	3 Tuesday

1 success	① radiation	1 by	① for
a 2 smouldering at the plant and	2 pollution was expected to leak	② through vents into the air	2 of up to a week.
③ problem	3 gently	3 tough	3 forcing

1 Because	① the	1 coldly
2 Representative Gary Hart, chairman of	2 forever Senate Public Works Subcommittee	② on nuclear regulation,
③ Senator	3 a	3 over

1 concrete	① site	1 controlled	① nuclear
said earlier ② during a visit to the	2 embankment that the incident was	2 "a most serious accident" involving	2 solar
3 at	3 seriously	③ the	3 simply

power generation in the United States.

Patterns of Writing

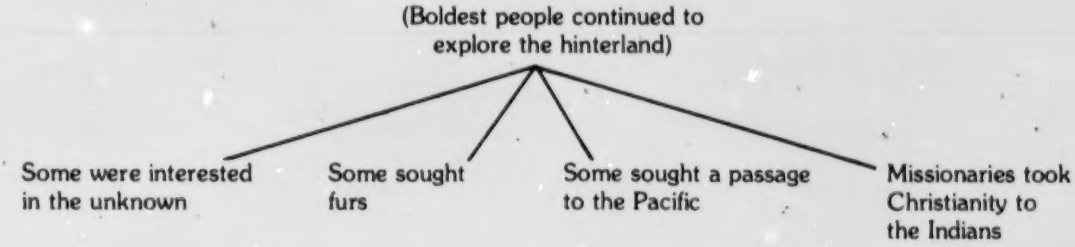
Well-known ways of developing ideas in writing including *generalization-elaboration, sequence, comparison-contrast, cause and effect, problem statement,* and *induction.*

Examples of patterns:

1. *Generalization-elaboration.* This writing pattern is often used in expository material. It lends itself to outlining or diagramming. The following example is from history.

Generalization-Elaboration (History)

Even when things looked darkest for New France, its boldest spirits pressed on with their explorations of the hinterland. Some of them were drawn into the wilderness by the mystery of the unknown; others by the hope of making a fortune in furs or of finding a passage to the Pacific. The missionaries, who were perhaps the most successful explorers, ranged far afield in their chosen task of carrying Christianity to the Indians.


(Boldest people continued to explore the hinterland)
Some were interested in the unknown
Some sought furs
Some sought a passage to the Pacific
Missionaries took Christianity to the Indians

2. *Sequence.* A series of steps in a process or a series of events is presented in a narrative. This pattern could be made visual in a flow chart representation of the sequence. The following example is from science.

Sequence (Science)

Making chinaware involves a process which begins with the shaping of articles from a dough-like mixture known as "pug-mill." The articles are then fired in the kilns, dropped in glaze ("slip") and again fired at a temperature of 1200 centigrade. Finally the china is checked, decorated or painted and given a last firing to set the trimming.

3. *Comparison-contrast.* In this pattern people, concepts, places, processes, or principles may be compared and contrasted. This pattern often includes words denoting contrast. The following example is from science. The word denoting contrast has been italicized.

Comparison - Contrast (Science)

All the objects studied thus far in this chapter have been set in motion by outside forces pushing or pulling on them. **However**, automobiles, airplanes, and people are able to set themselves in motion. They are self-propelled.

4. *Cause and effect.* In this pattern the results or effects of an action or process are explained. The following example is from history.

> Cause and Effect (History)
>
> Without hesitation, Nelson led his fleet along a narrow channel into Aboukir Bay and took the French fleet by surprise. Of 19 enemy battleships two were destroyed and nine captured. As a result of this battle, the island of Malta fell into British hands and became Britain's second naval base in the Mediterranean. More important still, Napoleon's line of sea communication was cut, and his invasion of the East had to be abandoned.

5. *Problem statement.* In this pattern necessary information for the solution of a problem is stated sentence by sentence. A final sentence usually states the problem to be solved. Most common in mathematics, this pattern should alert a reader to the fact that every piece of information may be vital to the problem's solution. The following example is from mathematics.

> Problem Statement (Math)
>
> There are 256 seventh grade students at Edishtron Junior High School. There are 224 eighth grade students in the school also. The principal of the school arranged the home rooms so that both grades have the same number of students in each home room. Furthermore, the number of students in each home room is as large as possible.
>
> A. How many students are in each home room?
>
> B. How many home rooms are needed?

6. *Inductive pattern.* In this pattern a reader is given observations, events, or phenomena which are followed by a hypothesized explanation which is then elaborated. The following example is from physical science.

> Inductive (Physical Science)
>
> If a few drops of hydrochloric acid are placed on a wad of paper in the bottom of a cylinder and some strong ammonia water is added to another cylinder, when the two cylinders are brought together, as shown in Fig. 3-14, a white smoke will form. This smoke is the compound ammonium chloride, a product of the reaction of ammonia and hydrochloric acid vapors. Because of their random and very rapid motion, molecules of the two vapors will combine and react chemically, as will be evidenced by the white smoke. In a continuous, random motion, the molecules, especially in the gaseous form, tend to move from their original locations. This motion is called diffusion, and it takes place in gaseous, liquid, and solid states.

Teaching patterns of writing:

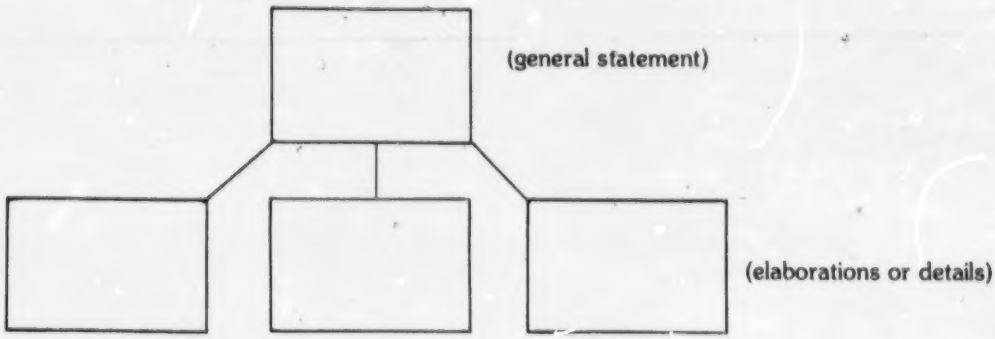
1. Alert students to the pattern or patterns in reading material.

2. Point out sign post words in a passage (i.e. however, on the other hand, furthermore) and discuss the functions of these words in a passage.

3. Alert students to the generalization-elaboration pattern by writing the first sentence (the generalization) on the board and ask students what they think the writer will write next. After a discussion of alternatives, read the passage with students and discover what the writer did write.

4. Ask students to diagram a passage. For example, a sequence pattern could be diagrammed as a flow chart.

A generalization-elaboration pattern could be shown as:



(Our thanks to the Nova Scotia Department of Education and their publication, *Reading to Learn Models*, for the ideas on this page.)

Structured Overview

A structured overview is a diagram which includes two vocabularies: (1) the key vocabulary needed to understand reading materials students are about to read and (2) vocabulary students already know which is related to key vocabulary. A structured overview is used by a teacher in introducing reading materials to students. A structured overview could be constructed for a single lesson, or an entire unit.

Constructing a structured overview:

1. Analyze the vocabulary of the reading-learning task and list all the words that you feel are important for the students to understand.

2. Arrange the list of words until you have a diagram which depicts the interrelationships between the concepts particular to the learning task.

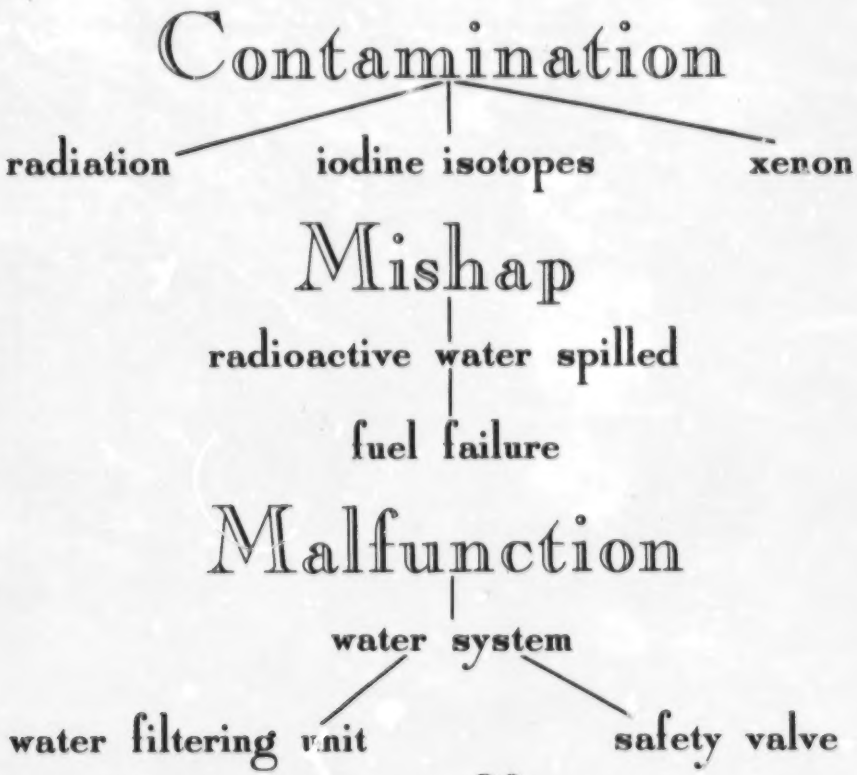
3. Add to the diagram vocabulary concepts which you believe are already understood by the students in order to depict relationships between the reading-learning task and the discipline as a whole.

Using a structured overview:

1. Introduce the students to the reading-learning task by displaying the diagram and explaining why you arranged the terms as you did. Encourage them to supply as much information as possible.

2. During the course of the reading-learning task, relate the new information to the structured overview as it seems appropriate.

A sample structured overview appears below. It is based on a newspaper article in *The Des Moines Register* for Friday, March 30, 1979. The article is reprinted in the section of these appendices on mapping.



Study Guide

A written plan which guides students through a reading assignment focusing attention on the major ideas and directing students' thinking processes. It may be considered a map to the content upon which a teacher wishes to focus. Study guides should be used with discretion. Not all assignments nor all students should be taught with a study guide. When using study guides vary the format so that students do not become bored. A study guide should not be graded or evaluated as if it were a test. Avoid using end-of-the-chapter questions as items on a study guide. When you have provided students with a study guide discover how well they are answering questions in the guide by using those questions for class discussion.

Constructing a study guide:

1. Recall the information you have about this reading assignment under *Step 2, Planning Assignments* of your guide to a successful reading experience.
2. Select the items from *Step 2, Planning Assignments* which you wish to include in this study guide.
3. Write guide questions representing several levels of *comprehension* (see explanation of this term in the glossary).
4. Arrange the items in the study guide so that students can record their answers on the study guide.

A study guide example:

The following sample study guide is constructed as a guide to a newspaper article, "Expert: Outside Danger Past in N-Plant Mishap", which appeared in *The Des Moines Register* on Friday, March 30, 1979. The article is reprinted, courtesy of the Associated Press, in the section on mapping in these appendices.

NOTE: Item I stresses key vocabulary for this reading assignment. Items II and III are literal level questions, item IV is an interpretative level question, item V is a critical level question, and item VI is a creative level question.

"Expert: Outside Danger Past in N-Plant Mishap"

I. What is the meaning of the italicized words in the following sentences?

1. "Our readings show *radiation* levels have dropped significantly," he said. . .
   radiation:
2. The water is contaminated with a very slight level of *xenon*, a low-level contaminant, according to DER officials.
   xenon:
3. But once the emergency system kicked on, pumping water into the *reactor*, the valve failed to close.
   reactor:
4. Hendrie and other federal officials told the congressmen there is no evidence the *malfunction* was a design problem that would show up in other reactors.
   malfunction:
5. Meanwhile, Lt. Gov. William Scranton III said one test for *iodine isotopes* in milk proved positive.
   iodine isotopes:
6. A federal inspector said Thursday that the threat of *contamination* to persons near the Three Mile Island nuclear plant was past,. . .
   contamination:

II. Complete the listing of events described in the article on the chart below.

Cause	Effect	Error: Human, Mechanical, or Natural Phenomena
1. valve malfunctioned	nuclear fuel failed	
2. nuclear fuel failed	100,000 gallons of water spilled	
3. water spilled	1% of metal cladding of uranium pellets melted	
4.		
5.		
6.		
7.		

III. What is one main idea of this article?

IV. Create a headline that might be a quote from Dr. Ernest Sternglass or George Wald.

V. What would you like to know that is not stated in this article?

VI. How might an article written a year from now in a newsletter for one of the following differ from this account?

1. American Association of Manufacturers
2. Clergy and Laity Concerned for a Nuclear Moratorium
3. Pravda

Vocabulary and the Improvement of Content Learning

Students can be helped over many rough spots in content reading by assistance with vocabulary problems. Key concepts (ideas), necessary for understanding material assigned, are expressed in key vocabulary.

Background

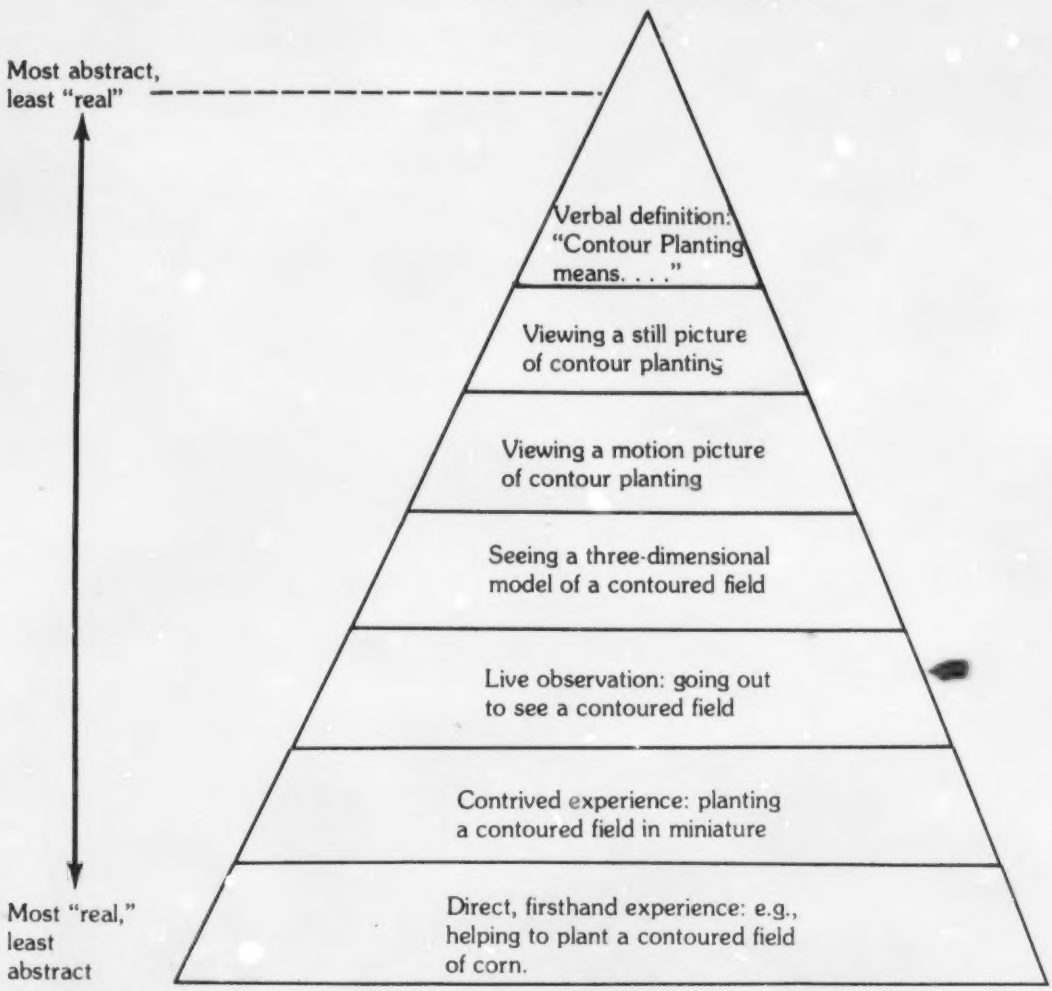
It may be helpful, in approaching any part of a lesson through attention to vocabulary, to be aware of three dimensions of general vocabulary development:

1. *Size of vocabulary.* One dimension of vocabulary development is acquiring some degree of command of an increasing number of *different* words.

2. *Extensiveness of meaning.* A second dimension is the range of *different meanings* (or shades of meaning) attached to given words. For example, note the word *drill.* Its definitions include: a tool for boring holes; an exercise in marching and handling weapons; strict training in a subject, often involving repetition.

3. *Depth of vividness of meaning.* The idea of the "cone of experience" is useful in understanding this third dimension: direct, first-hand experience provides the greatest depth or vividness of meaning — this is the base of the cone; simulated or set-up experiences are somewhat less direct; at successive levels, moving up from the base of the cone, are live observation, viewing motion pictures, viewing still pictures. At the apex of the cone — furthest removed from the direct, first-hand level — is verbal definition. The levels from direct or first-hand experience to abstract definition may be best understood in relation to a specific term, *contour planting*:

An Example: Cone of Experience


Most abstract, least "real"
Verbal definition: "Contour Planting means. . . ."
Viewing a still picture of contour planting
Viewing a motion picture of contour planting
Seeing a three-dimensional model of a contoured field
Live observation: going out to see a contoured field
Contrived experience: planting a contoured field in miniature
Direct, firsthand experience: e.g., helping to plant a contoured field of corn.
Most "real," least abstract

Word Analysis

In some instances, it may be most efficient to present a word as *sight-recognition vocabulary*. That is, the word is shown or pointed out to students and they are told its pronunciation and meaning. For possible transfer to other words, students' attention may be called to significant phonic or structural (morphemic) elements in the word.

1. *Phonic analysis*. The pronunciation of a word is determined, or at least estimated, by studying its sound-signifying elements: vowels, consonants, and their groupings into digraphs, diphthongs, blends, phonemes, and syllables.

2. *Structural (morphemic) analysis*. Constant, meaningful elements may be seen within a word. These are usually identified as *prefixes, root words, suffixes*, and *inflectional endings*. For example, the word *confluences* contains the prefix, *con*, the root element *flu*, the noun-forming suffix *ence*, and the pluralizing inflectional ending *(e)s*.

A third technique of word analysis which may be used in working with vocabulary is:

3. *The use of context*. Clues to a word's meaning (which may sometimes lead to complete identification of a word) are derived from the setting in which the word is used, that is in a phrase, a sentence, a paragraph, or longer units. A definition of, or synonym for the word may be found "planted" within the context. Or, a notion of the word's meaning may be derived from its use in comparison or contrast to another word; or the word may appear as a summary, or a reflection of a mood or situation. (More extended lists of specific types of context may be found in professional references.)

As a check on what has been determined through phonic, structural, and contextual analysis — or in case the word's meaning and pronunciation cannot be clearly determined by these means — dictionaries and glossaries should be used.

Application

Attention to vocabulary may be profitable at the following points in the guides for successful reading experiences:

Introducing reading materials. A limited number of terms, five to seven, which are crucial to understanding the lesson may be selected for brief pre-teaching. Pronunciation of each word should be included in such pre-teaching, but primary attention should be directed to the meaning(s) of a word and to word-attack clues which are associated with meaning (see **Word Analysis** above).

Students may be asked to note outstanding terms of which they are unsure, as part of their previewing of reading materials; or, the teacher may designate specific terms (again, a limited number) whose location in context should be part of a previewing activity.

The study of key terms as they are used in context may constitute a purpose set prior to silent reading of the material.

Eliciting and evaluating students' responses to reading. Discussing key (concept-bearing) terms may be an important part of the activities following students' reading of the material. Selective re-reading may encourage better comprehension of newly — or more clearly — understood vocabulary.